Title	Control of *Clostridium perfringens* in a model roast beef by salts of organic acids during chilling
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Abstract

Clostridium perfringens illnesses have been traditionally associated with inadequate cooling practices in retail food service operations. Thus, there was a need to determine the time and temperature for cooked meat products to remain pathogen-free and provide vital data for performing risk assessment on cooked meat. Control of *C. perfringens* germination and outgrowth by6 sodium lactate (Purasal), sodium lactate supplemented with sodium diacetate (Optiform), buffered sodium citrate IIonal) and buffered sodium citrate supplemented with sodium diacetate (Ional Plus) was evaluated during continuous chilling of a model roast beef product. Portions of ground beef (250 g) supplemented with NaCl (0.85%), potato starch (0.25%) and potassium tetra pyrophosphate (0.20%) were mixed with either Purasal (1.5, 3.0, or 4.8%), Optiform (1.5, 3.0, or 4.8%), Ional (0.75, 1.0, or 1.3%) or Ional Plus (0.75, 1.0, or 1.3%). Thereafter, each product, along with the control with no added antimicrobials, was mixed with a 3-strain spore cocktail of *C. perfringens* to obtain a final spore concentration of ca. 2.2 log10 spores/g. Inoculated products (10 g) were vacuum sealed in bags, heated to 60 °C within 1 h, and subsequently chilled from 54.4 °C to 7.2 °C in 18 or 21 h following exponential chilling rates. Products were sampled immediately after cooking and subsequent to chilling for *C. perfringens* populations. Chilling of cooked, model ground roast beef following 18 and 21 h chill rates resulted in growth from spores of *C. perfringens* to 6.33 and 7.60 log 10 CFU/g, respectively. Incorporation of antimicrobials resulted in < 1.0 log 10 CFU/g increase of the pathogen, except for beef with Ional Plus at 0.75% concentration, following 18 h chilling rate. Similar results were obtains when 21 h chilling rate was followed, with beef containing ingredients (at all the concentrations) resulting in either reductions or £ 1.0 log 10 CFU/g growth, except for Purasal and Ional Plus at 1.5 and 0.75% concentration, respectively. Use of sodium salts of organic acids in formulation of model roast beef can reduce the risk of *C. perfringens* spore germination and outgrowth during extended chilling rates.